

WHAT IS CLAIMED IS:

1. An adhesive composition for joining filled and top-sealed display cells on a first substrate or electrode layer in an electrophoretic or liquid crystal display to a second substrate or electrode layer, which composition comprises a high dielectric polymer or oligomer and a radiation curable composition.
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2. The composition of Claim 1 wherein said first or second electrode layer comprises a patterned electrode.
3. The composition of Claim 1 wherein said polymer or oligomer has a dielectric constant in the range of 2.5-17.
- 10 4. The composition of Claim 3 wherein said polymer or oligomer has a dielectric constant in the range of 3-15.
5. The composition of Claim 1 wherein said high dielectric polymer or oligomer is selected from a group consisting of polyurethanes, polyureas, polycarbonates, polyamides, polyesters, polycaprolactone, polyvinyl alcohol, polyether, polyvinyl acetate derivatives, polyvinyl fluoride, polyvinylidene fluoride, polyvinyl butyral, polyvinylpyrrolidone, poly(2-ethyl-2-oxazoline), acrylic or methacrylic copolymers, maleic anhydride copolymers, vinylether copolymers, styrene copolymers, diene copolymers, siloxane copolymers, cellulose derivatives, gum Arabic, alginate, lecithin, polymers derived from amino acids and a mixture thereof.
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6. The composition of Claim 5 wherein said cellulose derivative is selected from a group consisting of hydroxyethyl cellulose, propyl cellulose, cellulose acetate propionate, cellulose acetate butyrate and graft copolymers thereof.
7. The composition of Claim 1 wherein said high dielectric polymer or oligomer comprises a functional group for chain extension or crosslinking.
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8. The composition of Claim 7 wherein said high dielectric polymer or oligomer is selected from a group consisting of polyurethanes, polyureas, polycarbonates, polyesters and polyamides.

9. The composition of Claim 8 wherein said high dielectric polymer or oligomer comprises a functional group selected from a group consisting of -OH, -SH, -NCO, -NCS, -NHR, -NRCONHR, -NRCSNHR, vinyl, epoxide and derivatives thereof, wherein R is hydrogen, alkyl, aryl, alkylaryl or arylalkyl.

5 10. The composition of Claim 9 wherein said high dielectric polymer or oligomer is a functionalized polyurethane.

11. The composition of Claim 10 wherein said functionalized polyurethane is hydroxyl terminated polyester polyurethane or polyether polyurethane, isocyanate terminated polyester polyurethane or polyether polyurethane or acrylate terminated
10 polyester polyurethane or polyether polyurethane.

12. The composition of Claim 11 wherein said functionalized polyurethane is a hydroxyl terminated polyester polyurethane.

13. The composition of Claim 12 wherein said hydroxyl terminated polyester polyurethane is selected from the IROSTIC series (by Huntsman
15 Polyurethane).

14. The composition of Claim 1 wherein said radiation curable composition comprises a multifunctional monomer or oligomer.

15. The composition of Claim 14 wherein said multifunctional monomer or oligomer is selected from the group consisting of multifunctional acrylates, methacrylates, vinyl ethers, epoxides, acetylenes and allylenes.
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16. The composition of Claim 14 wherein said multifunctional monomer or oligomer comprises a pendant or end-capped acrylate, methacrylate, epoxy or vinyl group.

17. The composition of Claim 14 wherein said multifunctional monomer or
25 oligomer is a low molecular weight polyurethane, polyepoxide, polyester, polyacrylate, polymethacrylate, polycarbonate, polystyrene or polyether.

18. The composition of Claim 14 wherein said multifunctional monomer or oligomer has a molecular weight ranging from 300 to 20,000.

19. The composition of Claim 18 wherein said multifunctional monomer or oligomer is an aliphatic or aromatic urethane acrylate.

20. The composition of Claim 1 further comprising a crosslinking agent.

21. The composition of Claim 20 wherein said crosslinking agent is a
5 multifunctional isocyanate.

22. The composition of Claim 21 wherein said multifunctional isocyanate is an aliphatic polyisocyanate.

23. The composition of Claim 22 wherein said aliphatic polyisocyanate is Desmodur N-100 (from Bayer) or Irodur E-358 (from Huntsman Polyurethane).

10 24. The composition of Claim 20 wherein said high dielectric polymer or oligomer is a hydroxyl terminated polyester polyurethane and said crosslinking agent is a polyisocyanate.

25. The composition of Claim 24 wherein the molar ratio of the hydroxyl group of the hydroxyl terminated polyester polyurethane to the isocyanate group of
15 the polyisocyanate is 1/10 to 10/1.

26. The composition of Claim 25 wherein the ratio is 1.1/1 to 2/1.

27. The composition of Claim 20 further comprising a catalyst.

28. The composition of Claim 27 wherein said catalyst is selected from a
20 group consisting of organotin catalysts, organozirconium catalysts and bismuth catalysts.

29. The composition of Claim 28 wherein said organotin catalyst is dibutyltin dilaurate.

30. The composition of Claim 1 wherein said radiation curable composition
25 is a cationic type of UV curable composition.

31. An electrophoretic or liquid crystal display which comprises display cells filled with a display fluid and top-sealed with a composition comprising a high dielectric polymer or oligomer and a radiation curable composition wherein said top-sealing composition forms a contiguous sealing layer between the display fluid and a substrate or electrode layer.

32. An electrophoretic or liquid crystal display which comprises display cells filled with a display fluid and top-sealed with a composition comprising a high dielectric polymer or oligomer and a radiation curable composition wherein said top-sealing composition forms a contiguous sealing layer between the display fluid and an adhesive or overcoat layer on a substrate or electrode layer.

33. An electrophoretic or liquid crystal display of Claim 32 wherein said adhesive layer is formed from a composition comprising a high dielectric polymer or oligomer and a radiation curable composition.

34. A method for improving the physicomechanical and electro-optical properties of an electrophoretic or liquid crystal device or display, which method comprises sealing display cells with a top-sealing layer which comprises a high dielectric polymer or oligomer and a radiation curable composition.

35. A method for improving the physicomechanical and electro-optical properties of an electrophoretic or liquid crystal device or display, which method comprises:

- (a) forming display cells on a first substrate or electrode layer;
- (b) filling a display fluid into the display cells;
- (c) top-sealing the filled display cells; and
- (b) adhering a second substrate or electrode layer to the sealed display cells with an adhesive layer comprising a high dielectric polymer or oligomer and a radiation curable composition.

36. A method for improving the physicomechanical and electro-optical properties of an electrophoretic or liquid crystal device or display which method comprises:

- (a) forming display cells on a first substrate or electrode layer;

(b) filling a display fluid into the display cells;
(c) top-sealing the filled display cells with a top-sealing composition comprising a high dielectric polymer or oligomer and a radiation curable composition; and

5 (d) disposing a second substrate or electrode layer onto the top-sealed display cells by lamination, coating, printing, vapor deposition, sputtering or a combination thereof.

37. The method of Claim 36 wherein said first or second electrode layer comprises a patterned electrode.

10 38. A semi-finished display panel which comprises:

a) an array of filled and top-sealed display cells on an electrode or substrate layer; and

b) a temporary substrate layer adhered to the top of the filled and top-sealed display cells with an adhesive layer formed from a composition comprising a
15 high dielectric polymer or oligomer and a radiation curable composition.

39. A semi-finished display panel which comprises:

a) an array of filled and top-sealed display cells on a temporary substrate layer; and

b) an electrode or substrate layer adhered to the top of the filled and top-sealed display cells with an adhesive layer formed from a composition comprising a
20 high dielectric polymer or oligomer and a radiation curable composition.

40. The semi-finished display panel of Claim 38 or 39 wherein said display cells are microcups, microgrooves or microchannels.

41. The semi-finished display panel of Claim 40 wherein said microcups
25 are prepared by embossing, molding or lithography.

42. The semi-finished display panel of Claim 38 or 39 wherein said temporary substrate is a release liner.

43. The semi-finished display panel of Claim 38 or 39 wherein said high dielectric polymer or oligomer is selected from a group consisting of polyurethanes,

polyureas, polycarbonates, polyamides, polyesters, polycaprolactone, polyvinyl alcohol, polyether, polyvinyl acetate derivatives, polyvinyl fluoride, polyvinylidene fluoride, polyvinyl butyral, polyvinylpyrrolidone, poly(2-ethyl-2-oxazoline), acrylic or methacrylic copolymers, maleic anhydride copolymers, vinyl ether copolymers, styrene copolymers, cellulose derivatives, gum Arabic, alginate, lecithin and polymers derived from amino acids.

44. The semi-finished display panel of Claim 38 or 39 wherein said radiation curable composition comprises a multifunctional monomer or oligomer.

45. The semi-finished display panel of Claim 38 or 39 wherein said adhesive layer further comprises a crosslinking agent.

46. The semi-finished display panel of Claim 45 wherein said adhesive layer further comprises a catalyst.

47. A process for the manufacture of a semi-finished display panel which comprises:

a) preparing an array of filled and top-sealed display cells on an electrode or substrate layer;

b) laminating a temporary substrate over the array of filled and top-sealed display cells with an adhesive layer formed from a composition comprising a high dielectric polymer or oligomer and a radiation curable composition on top of the filled and top-sealed display cells; and optionally

c) curing or hardening the adhesive layer.

48. A process for the manufacture of a semi-finished display panel which comprises:

a) preparing an array of filled and top-sealed display cells on a temporary substrate;

b) laminating an electrode or substrate layer over the array of filled and top-sealed display cells with an adhesive layer formed from a composition comprising a high dielectric polymer or oligomer and a radiation curable composition on top of the filled and top-sealed display cells; and optionally

c) curing or hardening the adhesive layer.

49. A semi-finished display panel which comprises:

a) an array of filled display cells on an electrode or substrate layer, which filled display cells are top-sealed with a top-sealing composition comprising a high dielectric polymer or oligomer and a radiation curable composition; and

5 b) a temporary substrate laminated on top of the filled and top-sealed display cells.

50. A semi-finished display panel which comprises:

a) an array of filled display cells on a temporary substrate, which filled display cells are top-sealed with a top-sealing composition comprising a high dielectric polymer or oligomer and a radiation curable composition; and

10 b) an electrode or substrate layer laminated on top of the filled and top-sealed display cells.

51. The semi-finished display panel of Claim 49 or 50 wherein said display cells are microcups, microgrooves or microchannels.

15 52. The semi-finished display panel of Claim 49 or 50 wherein said temporary substrate is a release liner.

53. The semi-finished display panel of Claim 49 or 50 wherein said high dielectric polymer or oligomer is selected from a group consisting of polyurethanes, polyureas, polycarbonates, polyamides, polyesters, polycaprolactone, polyvinyl alcohol, polyether, polyvinyl acetate derivatives, polyvinyl fluoride, polyvinylidene fluoride, polyvinyl butyral, polyvinylpyrrolidone, poly(2-ethyl-2-oxazoline), acrylic or methacrylic copolymers, maleic anhydride copolymers, vinylether copolymers, styrene copolymers, cellulose derivatives, gum Arabic, alginate, lecithin and polymers derived from amino acids.

25 54. The semi-finished display panel of Claim 49 or 50 wherein said radiation curable composition comprises a multifunctional monomer or oligomer.

55. The semi-finished display panel of Claim 49 or 50 wherein said sealing composition further comprises a crosslinking agent.

56. The semi-finished display panel of Claim 55 wherein said top-sealing composition further comprising a catalyst.

57. A process for the manufacture of a semi-finished display panel which comprises:

- 5 a) preparing an array of display cells on an electrode or substrate layer;
- b) filling the display cells;
- c) top-sealing the filled display cells with a sealing layer formed from a composition comprising a high dielectric polymer or oligomer and a radiation curable composition;
- 10 d) laminating a temporary substrate on top of the filled and top-sealed display cells; and optionally
- e) curing or hardening the top-sealing layer.

58. A process for the manufacture of a semi-finished display panel which comprises:

- 15 a) preparing an array of display cells on a temporary substrate;
- b) filling the display cells;
- c) top-sealing the filled display cells with a sealing layer formed from a composition comprising a high dielectric polymer or oligomer and a radiation curable composition;
- 20 d) disposing an electrode or substrate layer on top of the filled and top-sealed display cells by lamination, coating, printing, vapor deposition, sputtering or a combination thereof; and optionally
- e) curing or hardening the top-sealing layer.

59. A process for the manufacture of a semi-finished display panel which comprises:

- 25 a) preparing an array of display cells on a temporary substrate;
- b) filling the display cells;
- c) top-sealing the filled display cells with a sealing layer formed from a composition comprising a high dielectric polymer or oligomer and a radiation curable composition;
- 30 d) applying an adhesive layer on the top-sealed display cells; and

e) disposing an electrode or substrate layer on top of the adhesive layer by lamination, coating, printing, vapor deposition, sputtering or a combination thereof; and optionally

f) curing or hardening the sealing and adhesive layer.

5 60. A semi-finished display panel which comprises an array of filled and top-sealed display cells between two temporary substrate layers, which filled display cells are top-sealed with a top-sealing composition comprising a high dielectric polymer or oligomer and a radiation curable composition.

61. A semi-finished display panel which comprises:

10 a) an array of filled and top-sealed display cells on a first temporary substrate, and

b) a second temporary substrate laminated on top of the filled and top-sealed display cells with an adhesive composition comprising a high dielectric polymer or oligomer and a radiation curable composition.

15 62. The semi-finished display panel of Claim 60 or 61 wherein said display cells are microcups, microgrooves or microchannels.

63. The semi-finished display panel of Claim 62 wherein said microcups are prepared by embossing, molding or lithography.

20 64. The semi-finished display panel of Claim 60 or 61 wherein said temporary substrate is a release liner.

65. A process for improving the adhesion and physicomechanical properties of an electrophoretic or liquid crystal display, which process comprises:

25 a) activating a catalyst or photoinitiator in the sealing/adhesive or adhesive layer of the semi-finished display panel of Claim 38, 39, 49, 50, 60 or 61 before or after the temporary substrate is peeled off;

b) laminating the activated semi-finished display panel without the temporary substrate onto a second electrode or substrate layer; and optionally

c) post curing the finished display panel.

66. The semi-finished display panel of Claim 38, 39, 49, 50, 60 or 61 wherein the panel is in the form of a roll.

67. A finished display or device, which comprises:

- 5 (a) an array of filled microcups on an electrode layer wherein said filled microcups are top-sealed with a top-sealing layer comprising a high dielectric polymer or oligomer and a radiation curable composition;
- (b) a protective coating on the sealed microcup array.

68. A finished display or device which comprises:

- 10 (a) an array of filled and top-sealed microcups on a first substrate or electrode layer wherein said cells are top-sealed with a top-sealing composition comprising a high dielectric polymer or oligomer and a radiation curable composition;
- (b) a second electrode layer on the top-sealed microcup array wherein said second electrode layer is disposed onto the top-sealed microcup array by
15 lamination, coating, printing, vapor deposition, sputtering or a combination thereof; and
- (c) a protective coating on the second electrode layer.

69. The finished display or device of Claim 67 or 68 comprises one electrode layer.

20 70. The finished display or device of Claim 67 or 68 wherein said protective coating comprises a particulate additive.

71. The finished display or device of Claim 67 or 68 wherein said electrode layer comprises a patterned electrode.

25 72. The composition of Claim 1 further comprising a graftable polymer or copolymer.

73. The composition of Claim 72 wherein said graftable polymer or copolymer is radically or photochemically graftable with a composition comprising a vinyl or acrylate derivative.

74. The composition of Claim 72 wherein said graftable polymer or copolymer is a cellulose derivative or a polyvinyl alcohol derivative.

75. The composition of Claim 74 wherein said cellulose derivative is cellulose acetate butyrate (CAB), cellulose acetate propionate (CAP), hydroxypropyl
5 cellulose (HPC), hydroxybutyl cellulose (HBC), hydroxyethyl cellulose (HEC), methyl cellulose (MC) or carboxymethyl cellulose (CMC).

76. The composition of Claim 74 wherein said polyvinyl alcohol derivative is polyvinyl acetal, polyvinyl butyral or a copolymer thereof.

77. The composition of Claim 72 wherein said graftable polymer is
10 cellulose acetate, cellulose acetate butyrate, cellulose acetate propionate, polyvinyl acetal or a copolymer thereof.

78. The composition of Claim 72 further comprising a photoinitiator.

79. The composition of Claim 78 wherein said photoinitiator is benzophenone, ITX (isopropyl thioxanthone), BMS (4(*p*-tolylthio)benzophenone),
15 Irgacure 651, 907, 369 or 184.